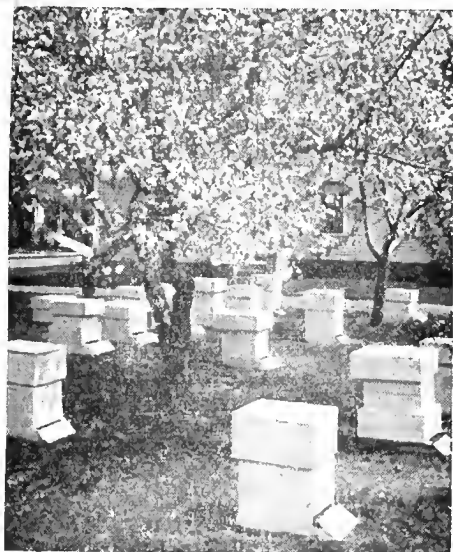


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Bees and Fruit

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Why Bees are Indispensable
in Orchards



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Published by
The A. I. Root Company
Medina, Ohio

Bees and Fruit Growing

There are several classes of fruit growers that for the purpose of this discussion may be divided into the following classes: (No. 1) those who do not know the value of bees and are honestly seeking information; (No. 2) those who have tried out a few bees in their orchards and see no apparent benefit from them; (No. 3) those who spray or dust their trees at the wrong time, killing the bees, and then wonder why they are of no benefit; (No. 4) those who know the value of bees as pollinators and wish to know when and where to get them, or whether they shall rent or buy; (No. 5) those who own bees and wish to know how to take care of them and get a crop of honey as well as of fruit; (No. 6) those who ignorantly believe that the doubtful good bees do is more than offset by the alleged damage they do in puncturing fruit or spreading blight among their trees.

The beekeeper has been furnishing colonies of bees too weak to get results in orchards and the fruit grower has not understood the conditions necessary for bees to do proper work in pollination in orchards. There have been disappointments and dissatisfaction on both sides. To remove these difficulties is the purpose of this booklet.

What is Meant by Pollination?

Before these questions can be satisfactorily answered, a preliminary statement should be made regarding

the general subject of pollination. It is derived from the word "pollen," the fertilizing element in all flowers so essential to the growth of seed and fruit and so necessary to give a balanced ration to the baby bees in a bee hive. Pollination means a transfer of the pollen from the male parts of the flowers to the female. Sometimes the male part is on one plant and the female part on another plant of the same species; but more often both the male and female parts are on the same flower. In a few cases the pollen of the same tree or plant can fertilize its own flowers. These are called "self fruitful". But in the great majority of cases the pollen must come from another tree or plant of the same kind before fertilization can take place. In these cases the blossoms are said to be sterile to their own pollen.

In many instances the pollen is carried by the wind or rain from plant to plant, and sometimes it is carried by certain insects other than bees. But in the case of most fruit trees such as apple, peach, pear, cherry, plum, almond, and citrus fruits, honeybees are almost the only agent for the transfer of the pollen. While other insects may do some of the work, they are not under the control of man and therefore are not often available. It has been proven that wind or rain has little or no value to transfer the pollen of fruit trees. It is, therefore, apparent that the fruit growers must use honeybees, whether wild or domestic, in order to secure the maximum results from their trees.

On the other hand, bees can not raise their young without what is called

a nitrogenous food. This comes almost entirely from the pollen of flowers. Without this pollen, brood rearing, and that means bee raising, cannot progress successfully as there is no practical substitute that will take its place. Old bees die off very rapidly and unless there is a constant accession of young bees the colony will soon go out of existence. Fruit trees must have the help of bees or other insects in order to bring about cross-pollination. Bees, on the other hand, must have the pollen that these very trees will furnish them. There is unmistakable evidence that bees increase the fruit crop; and it is for this reason that there is a very intimate and necessary relationship between the fruit grower and bee-keeper, as shown later.

It will now be in order to take up the questions propounded in the introduction in their numerical order.

No. 1.—The Value of Bees, or How and Why Bees Increase the Fruit Crop

What is the evidence to show that bees do actually increase the quality and quantity of fruit, particularly of apples, pears, plums, cherries, and the like? If one will critically examine the structure of the honeybee and the structure of the fruit blossom he will discover at once that the one helps the other. The correlation between the two is as striking as it is wonderful. The bees on the one hand are highly specialized with pollen gathering apparatus in the form of fuzz or hair, all over their bodies, of serrated hairs on the legs, and of pollen carrying apparatus on their hind legs. On the other hand, it is apparent that the flowers of

most of our fruits are made to entice bees. Apparently the flowers put out all kinds of inducements to attract their friends the bees. Some are highly colored, others show little or no color, but are rich with odor, nectar, or pollen, or all. Sometimes we find, as in the case of fruit trees, color, pollen, and nectar, as well as odor. Some flowers even go so far as to put out convenient door steps to attract visitors, as in peas and beans. This interlocking relationship is so marked that the reverent student of nature can hardly escape the conviction that the animal and plant kingdom, whether consciously or unconsciously, are working together in a friendly conspiracy for the benefit of both and for mankind. From the structural standpoint, what better proof could be advanced to show that the fruit trees need the bees and the bees need the trees, each carrying out its own end?

It is rather significant that there is not an experiment station in the United States that has not at one time or another mentioned the valuable and almost indispensable service performed by honeybees in orchards growing apples, pears, plums, and cherries, and in the growing of certain legumes such as alsike and white clover, as well as sweet clover, cucumbers, etc. All eminent biologists from Darwin down to the present time have spoken in the highest praise of bees in orchards. The proof is so overwhelming that it is almost unnecessary to go further in showing that the fruit grower can not afford to be without bees.

Practically all bulletins from the various experiment stations and from

the Department of Agriculture, Washington, D. C., show conclusively that the bees are absolutely necessary to secure the maximum results, both in quantity and quality of fruit. A fruit grower and a beekeeper should secure one or more of these bulletins. A careful reading will convince the most skeptical of the value of bees in orchards.

Nearly all the bulletins that have ever been issued on the growing of fruit have spoken favorably of bees.

No. 2.—Orchardists Who See No Benefit from Bees

For the benefit of those who have tried bees and find no apparent benefit from them, it should be said that there are many factors that have a bearing on this question. If the temperature at the time the trees are in full bloom is below 60 to 65 degrees, the bees will be unable to do much work on the blossoms. Their attention will be confined mainly to the trees nearest at hand. Those more distant will be neglected entirely. Should there be no warm days with a temperature higher than 60 degrees, the probabilities are that the bees can not get in their work. Likewise if it is windy, rainy, or misty, the bees will be unable to fly.

The conditions mentioned are beyond the control of man. It is, therefore, important to have a large force of bees available so that if there be a few hours of good sunshiny weather the bees can do their work.

Importance of Interplanting

But there are other factors which are in the control of man. The prac-

tice of planting fruit trees in solid blocks of one variety is a great mistake from the standpoint of pollination. Sometimes there will be three rows of one solid variety, then three rows of another variety. But unless these varieties are friendly to each other, that is, unless they are compatible so that the pollen of the one may pollinate the blossoms of the other, no number of bees could bring about results. No orchardist should put out his trees without first consulting his nearest experiment station. That station will tell him what varieties are best for him to grow on his soil and how to interplant the compatible varieties of apples, pears, and peaches. Some varieties of fruits are self fertile but the majority of them are sterile to their own pollen. That means that unless they have help from another variety in the immediate neighborhood, no number of bees will be able to bring about cross-pollination.

Where solid blocks of fruit trees of varieties that are incompatible or sterile to their own pollen have been planted, there are two remedies that can be applied. First and best is to top-graft some trees with some variety that will be compatible to the trees already in solid blocks. Top-grafting, however, will take time before results can be achieved. Immediate results for the season can be secured by the use of bouquets of flowers cut from compatible varieties of the trees of the right age of blossom. These can be put into tubs or pails and placed between the rows of trees. In either case, the advice of a competent orchardist, or better perhaps, the advice of an experiment station, should be sought.

Colonies Too Weak to Accomplish Results in an Orchard

In the early spring, at the time the fruit trees are in full bloom, colonies that contain only two or three frames of bees and brood will be of little or no value in an orchard, no matter if compatible varieties are placed near each other. Fruit growers should insist on strong colonies, hives that contain ten combs well covered with bees. Better results will be secured from two story colonies containing 20 combs of bees with brood in eight or ten of the combs. On this point, see Bulletin No. 190, by Dr. E. F. Phillips, published by Cornell University, Ithaca, New York, entitled "Honey Bees for the Orchard". Strong two story colonies are several times more effective than the ordinary one story colony.

Where it is not possible to buy or rent bees on combs in one or two story hives, the fruit grower will have to resort to package bees. He will require nothing less than a five pound package, and generally it is better to have about two of them to the acre. See Nos. 4 and 5 further on.

No. 3.—Spraying at the Wrong Time

In former years complaint was made that the fruit growers sprayed their trees while in bloom and the practice is all too common now in spite of the fact that experiment stations everywhere have shown that better results can be secured by spraying before and after bloom. To apply the poison while the trees are in flower is a damage to the fruit grower and to the beekeeper alike—to the grower because some of the delicate parts of the blos-

soms are injured, killing the embryo fruit; to the beekeeper because the bees will be poisoned in countless thousands. It means killing the goose that lays the golden eggs.

Perhaps it should be explained to those who are not familiar with the general spraying proposition that two kinds of sprays are used by the fruit growers—one known as the dormant spray, such as lime sulphur or oil to destroy the San Jose scale, and the other a poison to kill the codling moth and other chewing insects that develop during the growth of the fruit. Lime sulphur and oil are mainly applied to the trees during the dormant state, before they are in leaf or bloom, and are never harmful to bees. Indeed, they act as a repellant. The other spray, usually arsenate of lead solution or Bordeaux mixture, or generally both, should be applied after the trees are out of bloom, or just as the last petals of the flowers are falling. If sprayed or dusted into the blossom when the bees are gathering nectar, they will be poisoned.

One of the best authorities in the United States on fruit growing, no less a person than F. A. Waugh, author of the "American Apple Orchard," and in no way interested in bees or beekeeping, in Chapter III of that work says:

"Special attention should be called to the fact that apple trees should not be sprayed while in blossom. Spraying at this time is not always totally without value, but in many cases it is not only unnecessary, but even highly dangerous to the crop. Under all circumstances it is very likely to poison the bees working on the apple blossoms.

This sort of damage is far-reaching in many cases; and as the bee is one of the fruit grower's best friends we can not afford to murder them in this way."

So far as known every experiment station in the United States advises against spraying or dusting while the trees are in bloom.

Dusting Often Destructive to Bees

In 1922 and 1923 many fruit growers began the practice of dusting their orchards with dry poisonous powder in place of using water in the form of spray to carry those same chemicals to the trees. A large area of orchards can be covered with dust, and in less time, than by the use of liquid sprays; but much more chemical is required. But the dust carried by the wind falls upon the other bloom on which bees are working. Experience showed that hundreds of colonies were killed and many hundreds of others weakened, in many states and particularly in New York in 1923 where the dusting method has become more or less prevalent. Bees were killed in New York in such numbers that beekeepers had to remove their bees from the vicinity of the orchards where dust was applied. It was hoped that some repellant might be used in connection with the poison dusts that would drive the bees away from the bloom; but nothing of that kind has been found. Some work was done by the Minnesota and the Connecticut Experiment Stations, showing that the dusting method for killing the codling moth is not so effective as the spray. Even some of the large fruit growers themselves are in doubt as to whether it pays to use it, and not a

few are abandoning their dusting apparatus because the area of the dust can not be controlled. Sometimes dusting is wholly ineffective because dust does not lodge where it will do good. Dr. H. A. Surface, State Zoologist of Pennsylvania, has stated that dusting is not as efficient as spraying.

The difficulty is that the dust is carried everywhere by the wind and unless the foliage is wet with dew or rain it is blown into the air. The dust may fall on the cover crop; and when it consists of any of the clovers it may fall on blossoms that are just in the height of the nectar secretion and upon dandelion blossoms in or near the orchard. Bees gather this poisoned nectar and die by the thousands. The dust may be carried hundreds of yards in all directions. Even though the bees may not be working on the clover blossoms they may take up the morning dew from the grasses and plants that have been dusted previously with arsenical mixtures. When the spray is used the effect is strictly local, and only on the trees that are out of bloom.

As a rule it is much safer to move bees from the orchard entirely when arsenical poisons are applied either in the form of a liquid or dust. If the orchardist will take the proper precaution to apply the dust when there is little or no wind, in the early morning when the dew is abundant, and if he will wait until the petals of the flowers have fallen and no other nectar-bearing flowers are in or near the orchard, no bees will be killed. Dusting machines are not here condemned when used at proper times.

It should be stated that neither

dusting nor spraying lime sulphur alone will do any harm to the bees, as the lime sulphur is not poisonous, and, what is more, the bees will not go near trees that are not in bloom.

DDT Our Friend Rather than Our Foe

The appalling losses of bees from the use of arsenicals, as reported from all over the country, presented a problem that was difficult to solve. Up to recently nothing seemed to be as effective as arsenic mixed with other poisons in the form of a spray or a dust. In either case a rain would wash off the poisons making it necessary to apply fresh amounts of arsenate of lead, and often there seemed to be no hope in sight until recently, and that hope came from the most powerful insecticide the world has ever known. Strange as it may seem, it is apparent from the evidence at hand that DDT will, to a large extent, displace arsenicals that have been causing the awful destruction of bees, sometimes resulting in controversies and lawsuits between beekeepers, farmers, and fruit growers.

Late work in the laboratory and in the field is piling up showing almost conclusively that both the horticulturalists and the beekeepers will welcome the use of DDT. While it will kill bees when confined in cages or in beehives, either in the form of a spray or dust, it has now been pretty well proven that DDT, when properly applied, under field conditions, is far less destructive to bees and other pollinating insects than the arsenicals which require frequent applications to make them effective. Recent tests made by Ed-

ward Gould, West Virginia Experiment Station, on 800 acres of orchards, operated and owned by the Consolidated Orchard Co., were entirely successful.

No. 4.—Where to Get and Where to Place Bees for Orchard Work

When there are single orchards of not over three or four acres in size, the bees in the neighborhood may be sufficient to take care of the trees when they come into bloom; but when orchards reach the size of five to ten, fifty or one hundred acres or more, it is necessary to restore the balance of nature by putting enough bees into the entire area covered by the trees to do the work of pollination. Usually a colony to the acre of mature trees, if the colony be strong, is considered enough bees to do effective work. If the trees are ten or fifteen years old half that number will be sufficient.

The next question is where and how to get the bees. If there is a local beekeeper in the vicinity, one who will have strong colonies at blooming time, not weaklings, arrangements can be made either to rent or buy the bees. The author recommends renting with the understanding that spraying and dusting are to be done when no flowers are in bloom in the orchard. Usually a beekeeper, if he brings strong colonies, can not afford to move them into the orchard and then out again for less than \$5.00 per colony. The amount of nectar or honey that the bees will get from the fruit trees will, as a rule, be negligible. If there could be nice, steady warm weather during the entire period when the trees are in bloom, the bees might gather enough honey to

recompense the beekeeper without any compensation from the fruit grower. When bees are rented or purchased for the work of pollination, fruit growers should always stipulate that the colonies be strong. That means that every comb should be well covered with bees. It would be far better to have the colonies two story, with bees in both stories. If the work of pollination is confined to just a few hours a strong colony will do much more effective work than a weak one in the same given time.

No. 5.—Buying Bees Rather than Renting

In some cases it is advisable and certainly cheaper to buy the colonies outright. The fruit grower would then have to be a beekeeper or become one in order to give them intelligent care at the right time. With the literature now available on how to handle bees, this should not be difficult, for it takes no more skill to take care of bees than it does to run an orchard.

It is a very nice arrangement for a group of orchardists in a vicinity to buy bees, keep them permanently, and employ a competent beekeeper to look after the bees in all the orchards. In other cases the orchardist is such an extensive grower that he can afford to run the bees and his orchard both at the same time, and employ a competent man the year around. When the bee man is not at work with the bees, he can do work in the fruit orchard, letting the bees shift for themselves during that time. This is being done very successfully in many cases.

Package Bees

There are a large number of localities where there are extensive orchards—so extensive that the wild bees and occasional bees owned by beekeepers are wholly inadequate to do the work of pollination. In such cases the orchardist may buy swarms of bees in cages without combs that can be sent from the South to northern orchards by express. Should it be necessary to resort to the purchase of package bees for the orchards, write to the publishers of this booklet for a pamphlet on Combless Package Bees, and names of shippers of package bees.

Our ABC & XYZ of Bee Culture, an encyclopedia on bees, has over 35 double column pages devoted to bees in orchards. The chapters on this subject are well worth the price of the whole book.

It seems like a waste to destroy package bees and if the orchardist doesn't care for them after pollination he perhaps could get someone who would be willing to place the bees in hives in order to have them ready for next season's work.

There are bee disease laws in nearly all of the States and any bees that are left by themselves not on combs would probably be destroyed by the state bee inspector, unless otherwise disposed of.

No. 6.—Bees Not Guilty as Charged

There are a few who believe bees do more harm than good. The attempt has been made to prove that the bees have been the means of scattering pear blight or fire blight on apple trees. The "evidence" against the bees is at

best incomplete and inconclusive. There have been a large number of experiments conducted to determine this matter and it has been shown that bees have little or no part in the spread of pear blight, twig, or blossom blight. This blight is a bacterial disease that attacks the twigs and the ends of the branches. If not checked, it may extend to the entire branch or tree. In the spring the affected limbs exude a gummy substance filled with germs called "holdover-cankers". It has been definitely proven that flies, aphids (or plant lice), leaf hoppers, and certain other bark-piercing insects, in connection with rains, are the means of carrying this blight. It has been observed that when the plant lice are abundant, fire blight is most prevalent. It is also proved that bees will not visit blighted blossoms, although they will visit freely the healthy ones on the same tree.

J. H. Merrill, formerly of the Kansas Experiment Station, Prof. H. A. Gossard, Wooster Experiment Station, and Prof. A. L. Pierstorff, plant pathologist, Ohio State University, have conducted experiments showing that bees are not the means of scattering blight.

In brief: Fire blight appears both before and after pear and apple trees are in bloom, and it is well known that bees do not visit the trees except for nectar and pollen; the germs of blight must be pricked into the tender tissues of the limb and honeybees have no means of puncturing or piercing the bark; experiments show conclusively that fire blight can be and is spread by hosts of sucking and biting insects, and not by bees.